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COMMONWEALTH OF PENNSYLVANIA.

REPORT

OF THE

STATE COMMISSIONERS

OF

FISHERIES,

For the Year 1873.

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REPORT.

To His Excellency J. F. HARTRANFT,
Governor of the Commonwealth of Pennsylvania:

Having been appointed by you, under the authority of an act providing for a Board of Commissioners of Fisheries, and defining their duties, approved April 28, 1873, we beg leave to present the following report:

A large number of streams running through our State have become so depopulated of fishes by persistent, wanton slaughter as to render them almost valueless to our people as a source of food. This condition of our public waters can only be remedied by carrying forward the movement inaugurated by the Legislature of 1873, when, looking towards the protection and propagation of fish, they created a Board of Fishery Commissioners and placed at their disposal for expenditure, in connection with the object of their creation, a liberal amount of money.

The enterprise of introducing new varieties of fishes, and of re-stocking our waters with fishes that have been *habitats*, is one of vast importance to the people of the State, affording, as it would, an additional source of abundant food, and creating a means of livelihood for a large mumber of our citizens, and in this way amply compensating for the comparatively small expenditure required to make our waters teem with life.

The increase of fish by artificial propagation is no longer an unsolved problem, but has become an established fact. The whole doctrine is built upon the fundamental principle that the egg of the female fish is fecundated after expression from the female by peculiar muscular action, by the milt of the male being brought in contact with it. After having selected a proper place for spawning, the character of which depends upon the nature of the fish selecting it, the female emits her eggs; the male immediately after ejects his milt in close proximity to the spawn of the female, and bringing it at once in contact with a greater or lesser number of the freshly spawned eggs. This process of fecundation taking place, as it ordinarily does, in a considerable body of water, often in a stream marked by rapid currents, a large proportion of the eggs do not come in contact with the milt of the male, and are, therefore, not impregnated. A large number are also eaten by smaller fishes, which are always to be seen in great schools in the neighborhood of those spawning, feeding upon the eggs, and consequently but a small proportion of the spawn of the parent fish ever arrives at maturity.

The fish-culturist has improved upon nature by expressing the spawn from the female and the milt from the male by a peculiar manipulation, which is only acquired by considerable practice, and by confining both the milt and the spawn in a small vessel, by reason of which the two are brought in contact so immediate that all the spawn of the female are impregnated. The eggs are then placed in hatching boxes where they are carefully and closely watched and cared for until the young fish burst through their envelope.

When they first make their appearance they have attached to the middle of their bellies a sac, called the umbilical sac, containing the yolk of the egg, which constitutes their food for a considerable period after hatching. This sac is at first as large as the egg itself, but is gradually absorbed, the little fish meanwhile assuming more and more the shape and marking of the parent fish. When the sac is entirely absorbed, the fish-culturists' work is generally completed, the fish being in condition to be set at large to enable them to seek their food. This is the process which is called artificial propagation. Some idea of the advantage of artificial over natural propagation may be gathered from the statement of the fact, that with shad, 98,000 fish can be procured from one pair of large fish by the artificial method, whereas by natural spawning they would yield but 2,000.

SHAD.

Illegal, indiscriminate and wasteful fishing has almost depopulated the great streams of our State emptying into the Atlantic, which at one time abounded with this valuable and esculent fish. The Delaware river is in a more depleted condition than the Susquehanna. During the last season there were not upon the Delaware river six fisheries, the catch of shad at which period proved remunerative to those operating them. The largest shore fisheries upon the river, by the slenderness of their yield, entailed an actual loss upon their owners. This deterioration is due to several causes.

FIRST. *The practice of fishing with drift nets in the lower portion of the rivers.*

These nets are not attached to any locality, but are placed across the channels, and are carried along the streams by the tide, oftentimes a distance as great as fifteen miles, catching all the fish that come within reach of the net, and when fishing on the ebb tide turning and chasing down the river many more fish than are caught that are on their annual journey to their spawning grounds. The manner of fishing with these nets is thus described by the Fish Commissioners of New Jersey in their report for 1872.

"Their length varies between one hundred and eight fathoms, and they will average perhaps three hundred, an enormous sum total is reached of three hundred thousand yards, over one hundred and seventy miles. The largest of these require but one light skiff, with two, or at most, but three men to manage them. Being constructed of fine twine they are almost imperceptible to the fishes in the turbid tide waters. When later in the season the water becomes clear greater execution is done on this account by fishing at night. The mesh, according to the statement of Mr. Wilkins, was formerly six and one-fourth inches, it is now reduced to five and one-fourth, and even less, sufficiently large, however, to admit of the shad getting its head so far through the mesh that it is fastened by the gills, hence the term gill net."

"These seines have both a lead and a cork line, by which they are held in a vertical position as they drift with the current. With the treble view of economy of material, the prevention of injury by vessels of light draught in passing over them, and to enable the same net to be used with facility in either deep or shoal water, the upper margin of the net is supported by long and slender cords of from five to seven feet in length, to the free ends of which, corks or wooden floats are attached. The sein thus constructed is laid upon the stern of the skiff, one or two men, according to its size, row the boat across the current, while another standing on the stern carefully casts the net into the water. This done, it is suffered to drift with the tide, direction being given it by the boat to which one end remains attached. After the net has drifted a sufficient length of time the fishes are removed from it, either by under-running it or by replacing it upon the stern of the boat, again to be cast into the water. Immediately upon the appearance of the shad in the upper portion of the bay, ordinarily in March, the longest of these seins are there placed to interrupt them. Fishing continues from Fort Delaware southward until about the first of May, when the sturgeon become numerous and troublesome, and the shad having pushed their way further upward, the gilling seins are shortened, and for the remainder of the season keep pace with the shad as they ascend the river. It is not to be supposed from the above that drift net fishing is confined to the head of the bay, or lower portion of the river, on the contrary, from Trenton all the way down, the current is literally fenced across at short intervals by these seins.

"From Trenton to a considerable distance down the stream, wherever the depth of water will permit it, and also at certain points upon the upper Delaware, a very objectionable practice prevails; the net is stretched across the channel and there staked or anchored for a considerable time, after which it is loosed and allowed to drift.

"It has been stated by reliable persons engaged in gill fishing, that in fair weather from two to three "slacks" are taken daily, the nets laid off on the flood-tide an hour or two before high water and fished till two or three hours after high water. So, too, on the ebb, the net being laid off two or three hours before low water and taken out an hour or two after ebb-tide. Thus, on an average, over twelve hours out of the twenty-four are occupied in fishing. The longer portion of time is during the ebb-tide, the effect is, of course, to backen the schools of shad down stream longer and further than they drive them up with the flood."

SECOND. *The "close time" or the time during which fishing is forbidden in the rivers not being sufficiently long and not being observed.*

The annual supply depends, of course, upon the ability of the shad to reach proper places for the deposit and hatching of their spawn. In journeying up the stream they meet net after net which have been thrown across the channels for their capture. All the inventions which human ingenuity can devise are placed to entrap them, in consequence of which but a small proportion of those which originally start from the sea succeed in reaching their spawning grounds. Without a "close time" it would be marvelous if any ever did! The object of the "close time" is to allow a certain interval during which the river shall be free of nets, and an open highway, offering no obstructions to the free ascension of the shad. If our streams are ever to be repleted, the observance of this "close time" must be enforced. This can be done to a great extent by the appointment of proper and efficient fish wardens.

The present "close time" commences at midnight on Saturday of each and every week during the fishing season, and continues until midnight Sunday. It permits, however, certain nets to be set or laid out at one turn of the tide during said "close time." We earnestly recommend an extension of the "close time," by having it commence at sunset on Saturday night, instead of midnight, and making no exceptions for any nets. What objection there can be to this six hours' extension we cannot understand, while its advantages are obvious. Shad caught on Saturday night, between sunset and midnight, cannot be sent to market until Monday, and being kept this length of time at a fishery during the late spring or early summer without ice, or other means of preservation, their condition, when brought to market, is not such as to delight an epicure. A law would be a good law which would prevent the catch of Saturday night being carried to market, were we to consider the question one of pure hygiene. But when it prevents a useless destruction to further advantageous increase, there should be no hesitancy in granting the necessary legislation.

THIRD. *The destruction of the young shad when returning to the sea by fish-baskets.*

Of all implements for the wanton destruction of fishes which have ever been constructed by human skill, the one most worthy of condemnation is the ordinary fish-basket. These instruments of extirpation are placed in the mid-channel of the river, with long arms or wings made of stone, extending up on either side towards the shores. Every living creature carried by the current is swept into these baskets. Young shad are peculiarly delicate. A blow which displaces a scale will result in the death of the fish, so that scarcely a young shad which succeeds in going through the slats of the basket will live, while millions are stopped upon the basket, and there allowed to die. Instances have come to our knowledge where, in 1870 and 1871, parties owning baskets were obliged to shovel out with a wooden scoop the young shad that had accumulated in their baskets in less time than one night. In one instance the owner of the basket said that "he thought in one night he had thrown from his fish-basket *more than a cart-load of young shad.*" It is not probable that one survived. Is it any wonder, considering these facts, that our streams have become depopulated? Since the progressive steps which we have made in our Commonwealth within the past few years for the protection of the fish, we are happy to report that the baskets have nearly all been demolished. We have met with some difficulty on account of the peculiar construction of the law requiring ten days' notice to be given by the sheriff before proceeding with a *posse comitatus* to destroy the basket. We earnestly recommend that that portion of the law requiring the ten days' notice, be stricken out, and that the passage of the law shall be in itself sufficient notice. And that in addition to the required destruction of the baskets, an act imposing a penalty for the erection or maintenance of fish-baskets be passed. With this law upon our statute books, and the means which are now at our command, we believe that in another year we will be able to state the fact that not a single fish-basket will remain as a scourge to our rivers.

These being the causes of the depletion of our rivers of shad, the remedy is, to a certain extent, the removal of the evil which caused it. With the drift net this is impracticable. This interest is too large and too valuable to be swept away by a summary enactment. A proper "close-time," and a strict observance thereof, will, to a great extent, assist in repairing the breaches which these nets make in our fish population. Besides the ground (if we can use the term in connection with a fishery) is one which is generally inaccessable to a shore fishery, and consequently the only means of fishing it is with a drift net. The fish baskets, however, must be abolished from our streams, as the first step in the restoration of our fisheries. Where they catch one fish they uselessly kill a hundred. Our chief reliance, however, in reviving our shad fisheries must be by artificial propagation.

Immediately after our appointment as Commissioners of Fisheries we placed ourselves in communication with Mr. Seth Green—the well known fish culturist, of Rochester, New York—and concluded an arrangement by which we purchased from him the right to use his patent hatching-boxes for shad for three years, in the State of Pennsylvania, for the sum of $2,000. We desire to say in explanation that for a long time a feasable method of artificially hatching shad had been undiscovered by fish culturists. The eggs of the shad having a specific gravity but little greater than that of water, the attempt to hatch them by the method ordinarily used in hatching fish resulted in failure, on account of the eggs being swept out of the boxes by the current of the water running through them. A reduction of the current resulted in the death of the spawn. Mr. Green attempted the hatching of the spawn in boxes having the bottom covered with musquito netting and anchored in the stream so as to float half submerged. This experiment resulted in the hatching of about five per cent. of the fish. One day while working about the boxes he accidently tipped up the upper end of one of them. By doing this the bottom of the box presented a face to the current. The peculiar rotary motion this gave the current of the water passing through the box, at once convinced him that this was what was desired, and that the problem of artificially hatching shad was solved. By attaching floats to the sides of the boxes so as to maintain them in this position, he then succeeded in hatching ninety per cent. of the spawn. He subsequently improved upon this method by some other alterations of the boxes, and obtained, from the United States Government, letters patent upon his discovery. This is the only method known by which shad can be artificially hatched. Marvelous results have been obtained in the streams of other States by the use of this appliance. In the Connecticut river, where the fisheries were fast being abandoned on account of the scarcity of fish, the third year after these boxes were used in the hatching of shad, (shad return mature fish when three years old,) the catch in that river exceeded that of any year in its history. Fisheries which had been in existance for nearly a century, and at which records of their annual catch were kept, reported their yield of 1870, as being larger than that of any previous year. The Commissioners of Connecticut did not discontinue their shad hatching operations, but have carried them on until the present time. The result of this is that in their report for 1873, they say: "The number of shad running in the Connecticut river has increased to such an extent that the complaint of the fishermen is no longer a paucity of fish but that the market is so overstocked that they do not obtain a renumerative price for them." The same desirable result has been obtained by the use of those boxes in the Hudson river, but not to so great a degree, owing to a lack of good spawning grounds upon which to take the shad. That we can do as much for our own rivers, as has been done for the Connecticut and Hudson, we entertain not the slightest doubt.

After we had concluded the purchase of the right to use the boxes, Mr. Green came on to Pennsylvania, with one of his assistants, Edward H. Bhame. We at once established our point of operations at Newport, in Perry county, at the fishery of Messrs. Miller & Kough. Owing to the remarkable low temperature of the water it was some days after our location at Newport before Mr. Bhame succeeded in taking any females ready for spawning. Then the temperature of the water underwent a sudden change. At the time of the establishment of Newport as a base of operations the temperature of the water was about 62° ; within a short time afterwards it rose as high as 75° and at one time reached 82° Farenheit. This sudden change very visibly affected the fish, quite a large number being taken with the spawn dead within them. This prevented our operations from being as successful as they otherwise would have been. Mr. Bhame succeeded, however, in turning into the Susquehanna, at Newport, 2,700,000 young shad. Mr. Welcher, another of Mr. Green's assistants, who was in the employ of Prof. Spencer F. Baird, the United States Commissioner of Fisheries, was sent by Prof. Baird to the Susquehanna to assist in the hatching of shad, the State of Pennsylvania paying all the expenses of hatching other than that of his own personal compensation. Owing to the suddenness with which the warm season set in, he was only able to hatch and turn into the Susquehanna, at Columbia and Marietta, about 500,000 young shad. The total number of shad hatched by the artificial method during the past year in the Susquehanna was consequently in excess of 3,000,000. The yield of the fisheries in the Susquehanna, above the Columbia dam, was largely in excess of and much more profitable to those operating them than it has been for many years. The entire catch of all these fisheries must have exceeded fifty thousand. This was due to the abrasions in the Columbia dam, which were several hundred feet in length and which were created by the immense quantities of ice which were swept down the river by the winter and spring floods, and which formed in an immense ice gorge immediately upon the crest of the dam.

Owing to the failure of the act appropriating a certain amount for the hatching of shad in the Delaware by the Legislature of New Jersey, we could not make use of the money appropriated for the Delaware by Pennsylvania. The Commissioner of the General Government, however, established a hatching station along the Delaware at Point Pleasant, Bucks county, which was in charge of Dr. J. H. Slack, one of the Fish Commissioners of New Jersey and Assistant United States Commissioners of Fisheries. At this point nearly a million young shad were hatched and turned into the Delaware. The result of these operations will not be made manifest until the return of these fish from the sea, which will not be until the lapse of three years from the time of hatching.

We believe that with the establishment and observance of a "close time" of a longer duration than the present, the abolition of fish-baskets and a rigorous prosecution of artificial propagation that our rivers will soon be better supplied with shad than at any period of their history; that instead of being, as now, a high priced luxury, they will be a cheap and abundant article of diet.

BLACK BASS.

There are two varieties of this fish which are valuable for stocking the waters of the State. The one is the black bass of the North, (*Grystes Nigricans*,) which is more particularly adapted for stocking lakes and ponds. The other is the black bass of the south, (*Grystes Salmoides*,) which thrives best in streams of running water. The work of stocking the waters of the State with black bass has been entirely confined to the transportation and deposition of the latter variety. The extreme difficulty and great expense in obtaining and transporting the *Grystes Nigricans* has deterred us from placing these fish in any of our waters. We have but few lakes in the State in which we could introduce them which are not either owned or controled by individuals, except those in the north-western portion of the State, and these lakes are already inhabited by these fish. We believe, however, that the *Grystes Salmoides* will become habituated to our smaller lakes. In consequence of which belief we propose during the coming season to furnish these fish for stocking all the lakes in our State which are open to the public for general fishing.

Black bass is one of the most prolific varieties of our fresh water fish. Their natural increase is so great and their growth so rapid that it never has been an object to fish culturists to attempt their artificial propagation. When the spawning season draws near, they select, guided by natural instinct, with great care for the purpose of propagation certain portions of the river having a pebbly gravelly bottom. From these they remove carefully all sediment, weeds and sticks. This work completed leaves a clear bright space in the bottom of the river, circular in form, and having a diameter of about three feet. These beds are readily distinguished by the casual observer from the ordinary bottom of the river by their brightness, the gravel having the appearance of having been washed or scoured. When the parent fish are ready to spawn the female goes upon this prepared bed and deposits her spawn in a glutinous band or ribbon running in various directions across the bed. She is followed by the male who impregnates the eggs by the expression of his milt. They then relieve each other in guarding this bed driving from its vicinity every kind of predatory fish, even the pike and turtle. After the little fish are hatched the parents do not leave them immediately, but remain with them for a few days caring for and protecting them. This care (the exercise of which is peculiar to the bass, sunfish and catfish) taken in connection with the fact that a large pair of bass will deposit 40,000 eggs will give some idea of their fertility.

Fifteen of these fish carried from the west in the tank of a locomotive on the Baltimore and Ohio railroad, sixteen years ago, and deposited in the Potomac river near Harper's Ferry, has made them so abundant in that stream, that it to-day supplies the markets of our chief cities with this excellent fish. The annual catch in this river is beyond computation.

The rapid growth of these fish is marvelous, almost surpassing belief. When three months old they are three inches in length; at four months, four inches; at six months some of them will measure six and seven inches. We believe that these fish are capable of reproduction when a year old, having at that time attained the extraordinary length of eight or nine inches, but this is mere conjecture, based more particularly upon our knowledge of the size and weight of the fish at that age. They frequently attain the weight of five and six pounds; in rare instances seven and eight. They are unsurpassed in flavor by any of the perch family.

The following description of the fish is given by our fellow-citizen, Thaddeus Norris, in his book, "The American Angler:"

"Head and body dusky olive above, sometimes with a yellowish tint, lighter on the sides. Belly white; opercles light green, or greenish yellow; first dorsal fin nine spines and eighteen soft rays; pectorals fifteen; ventrals one spine five rays; anal three spines and twelve rays; caudal nineteen. Body elongated oval, straight on the belly, eye large, mouth very large, lower jaw longer. The vorner has brush-like teeth in front. Teeth on the palatines and pharyngeal bones. Tongue smooth; without teeth in front."

Three or four years ago a number of public spirited citizens residing along the Susquehanna, Schuylkill and Delaware rivers, conceived the idea of stocking these rivers with black bass (*Grystes Salmoides.*) They sent to Harper's Ferry, on the Potomac river, purchased a number of these fish, transported them to the localities selected for their introduction, and transferred them to the water. The result is eminently satisfactory. All these streams are now so well stocked with these fish that they promise, in a few years more, to rival the Potomac in the abundance of their yield. Bass are frequently caught weighing four and five pounds in these streams. They are believed to be the progeny of those originally transplanted from the Potomac. These fish are so readily taken with the rod, taking the bait so eagerly and greedily, that we recommend the passage of a law forbidding their being taken in any other way. Their agility renders it extremely difficult to take them during the summer and fall with nets. When caught within the sweep or bag of the seine during these seasons, they almost invariably regain their liberty by leaping out of the water and over the upper or cork line of the net, to the astonishment of the inexperienced fisherman. But during the winter months when they are partially torpid with cold, or in the spring when they are sluggish from the pressure of spawn and milt, it would not be a difficult matter to almost exterminate them by persistent fishing with small mesh seines. It would not be advisable to prevent, by legislation, the fishing with seines during the winter and spring, in localities where the fishing with these nets has become a large and profitable interest, as on the Delaware, nor do we recommend any such action. That which we do advise, however, is an enactment forbidding the keeping of any of these fish which may be caught at any time by persons fishing in any other manner except with rod and line.

The bass with which we stocked the waters of the State were taken principally from the Delaware river near Easton, a few from the Juniata river near Newport. We distributed throughout the State altogether two thousand and forty-four bass. These fish were transported principally under the direction of John P. Creveling, the Superintendent of our State Hatching House. So carefully was the work of transportation done, that out of the entire number there were not a dozen fish lost in the operation. The fish were conveyed in ordinary fifteen gallon milk cans, the temperature of the water in the cans being kept by the use of ice at about 62° Fahrenheit. The oxygen that was consumed by the fish was replaced by dipping the water from the cans in a vessel carried for that purpose, and pouring it back into the cans again from a considerable distance above them. The labor of transportation was considerable, necessitating the employment of six men in the work. We carried from twenty-five to fifty fish in each can, and rarely ever entrusted more than one can to a man. We desire to take this opportunity of giving expression to the obligations that we are under to the Pennsylvania Central, Lehigh Valley and Philadelphia and Reading railroad companies for the facilities that were placed at our disposal while carrying the fish over their respective roads. Everywhere that we have gone during the prosecution of our duties we have met with uniform kindness and courtesy on the part of all of our citizens with whom we were brought in contact, and a manifest interest in the successful issue of our labors.

The following is a list of the places at which the bass were deposited, and the number introduced at each place:

LEHIGH RIVER.

Chain Dam	115
Hope's Lock	26
Bethlehem	55
Allentown	27
Coplay	54
Laurys	64
Lehigh Gap	37
Parryville	25
Turnhole	66
White Haven	57
Total in Lehigh	526

NORTH BRANCH OF SUSQUEHANNA.

Wilkesbarre	75
Meshoppen	75
Towanda	75
Catawissa	75
Danville	75
Total in North Branch	375

WEST BRANCH OF SUSQUEHANNA.

Williamsport	63
Sunbury	50
Halifax	50
Lock Haven	50
Total in West Branch	213

JUNIATA AND ITS BRANCHES.

Hollidaysburg	25
Williamsburg Dam	40
Water Street Dam	50
Petersburg	40
Dam above Huntingdon	50
M'Veytown	50
Lewistown	50
Mifflin	65
Three Mile Level, (six miles east of Hollidaysburg,)	50
Total in Juniata	420

MISCELLANEOUS.

Reservoir, near Hollidaysburg, two and a half miles long by three-fourths miles wide	110
Yellow Breeches Creek	50
Pequa Creek	75
Chique Salunga Creek, (Mt. Joy)	75
Octoraro Creek, (Christiana,)	75
Pequa Creek, (Gordonsville,)	50
Cadorus Creek, (above York,)	75
Total	510

Making a grand total of 2,044 black bass deposited by us in the streams of our State. Besides this, the Delaware, Schuylkill, main branch of the Susquehanna river, the Raystown branch of the Juniata, and the Juniata at Huntingdon, were stocked by private enterprise previous to our appointment. The Conestoga was also stocked by a private pond, containing these fish, having burst its banks. We propose to continue the stocking of the streams of our State with bass during the coming season, if the funds necessary to do this are placed at our disposal.

There has been quite a demand made upon us for bass for the stocking of small streams, lakes and ponds in different portions of the State. The stocking of these smaller waters will not benefit a sufficiently large portion of our citizens as to warrant the State in bearing all the expenses incident to the operation. We consequently propose to furnish all persons desiring bass for these lesser public waters with the fish at certain points upon the Delaware and Susquehanna free of cost, the parties desiring them to bear the expense of transportation. The only aparatus required for their transportation will be twelve or fifteen gallon milk cans. The work of conveying them will have to be undertaken by an individual, it being impossible to send them from point to point, without such personal care, with any degree of safety. The expense of transportation will be very slight when divided among the many sending for the fish—whereas if borne by the State the aggregate expenditure would be considerable. We regret exceedingly that the condition of the waters of the western part of the State is, in many instances, rendered so unfit by their impregnation with coal oil and the refuse from bituminous coal mines as to prevent their more general introduction in that section.

SALMON.

The salmon is justly esteemed as the most excellent and valuable fish which inhabits the fresh waters of this continent. They were at one time abundant as far south as the Hudson river. Hendrick Hudson refers to the "great stores of salmon" seen by him when he first ascended the river which bears his name. We have heard of a tradition that salmon were at one time to be found in the Delaware, but this comes to us in such a vague and indefinite shape that but little reliance can be placed upon it. It is nevertheless true, that the salmon do make annual excursions from the sea into rivers of the islands of Great Britain, the temperature of which is as high as that of the Delaware. It is the opinion of many of our most learned ichthyologists that their introduction into the Delaware is so extremely probable as to be well worth the experiment. The Connecticut river was in its early history so prolific in its yield of this fish, that apprentices, in binding themselves to masters residing along its banks, insisted upon an insertion in the articles that they were not to be furnished with salmon as food oftener than twice a week. The wasteful, negligent and extravagant method of fishing which characterizes our American fishermen has now depopulated these streams entirely of these fish. Salmon are now to be found only in a few of the rivers of Maine, where they are not nearly so abundant as in the British Dominions (which government has been much more careful than we in the legislation intended for their protection) and on the Pacific slope.

There are two varieties of the salmon, the introduction of which it is the intention of your Commissioners to attempt, and, if successful, we think our people will have abundant reason for congratulation, in the fact that this magnificent fish, often attaining the weight of forty pounds, is numbered among our food fishes. These two varieties are the *Salmo Salar* and the *Salmo Quinnat*, the former is the salmon of our northern waters and of the islands of Great Britain; the latter, the salmon of California and the Pacific slope. The experiment of introducing the former will be made principally in the Delaware, the latter in the Susquehanna. Steps have already been taken, by the enterprise of private citizens and the Commissioner of the General Government, with the view of testing this experiment. In 1871 a number of gentlemen of Easton and Philadelphia, purchased of Mr. Wilmot, of New Castle, Canada, who has charge of the Government Hatching House of the British Dominion, 10,000 salmon eggs, which were placed in charge of a pisciculturist residing in Duchess county, State of New York. These eggs were hatched successfully, but owing to an unfortunate accident in attempting to transport them, a considerable loss was sustained, and but 2,500 were successfully deposited in one of the tributaries of the Delaware. The same gentlemen, in the following year, (1872,) instigated, as before, by Mr. Thaddeus Norris, of Philadelphia, purchased 13,000 more salmon eggs. These were sent directly to Easton, and placed in hatching boxes at a spring about a mile from that place. The hatching of these fish was under the immediate supervision of Mr. Norris himself, and, although the hatching apparatus was a rude one, owing to its being entirely intended for temporary use, he succeeded in hatching over 11,000 fish. These fish were introduced, with comparatively little or no loss, into the same tributary of the Delaware. In the early spring of 1873, before the appointment of your Commissioners, Prof. Baird, the United States Commissioner, presented to the State of Pennsylvania 40,000 of the spawn *Salmo Salar*, which were taken at Buckport, on the Kennebec river, in the State of Maine. There being no State funds which could be expended for the hatching of these eggs, and no commissioners to receive them, they were not formally presented to the State, but were given to Mr. Norris, he agreeing to receive and hatch them for the State of Pennsylvania. The expense was born by private contribution, by gentlemen of Philadelphia and Easton. These eggs were placed in hatching boxes, at a spring near the Delaware river, one mile from Easton. From these eggs 27,000 fish were hatched and placed in the Delaware. In addition to this gift of the United States to the State of Pennsylvania, 40,000 were presented to the State of New Jersey, and were taken charge of and hatched by Dr. J. H. Slack, one of the Commissioners of the State, at his private fish-hatching house, at Troutdale, New Jersey. Of this number he succeeded in hatching 33,000, 18,000 of which were placed in one of the tributaries of the Delaware. So that the entire number of *Salmo Salar* placed in the Delaware river during the last three years is 58,500. The young salmon of the hatching of 1873 were frequently seen and caught in the Delaware during the past year. The young salmon of the hatchings of 1871 and 1872, which, in their "*parr*" state, closely resemble young trout, in several instancs were caught and kept by the persons cathing them, who believed them to be trout. This establishes the fact that the salmon while young, before going to the sea, will thrive in our waters. We will be enabled to continue farther the experiment of introducing these fish into our rivers during the coming year, by reason of a proposed gift from the United States Commissioner of Fisheries of one or two hundred thousand more spawn of the *Salmo Salar*, from Buckport, Maine, the eggs to be delivered to your Commissioners at Buckport, and our State to be at the expense of transporting and hatching the eggs and the deposition of the fish.

In the opinion of your Commissioners, the introduction of the *Salmo Quinnat* from the Pacific slope in the Susquehanna river, is almost certain to be successful. The spawn of these fish are taken from fish inhabiting waters in California of higher average temperature than the water of the Susquehanna. In the early spring of 1873, six thousand of these fish, which were hatched by Dr. J. H. Slack, were presented to the State of Pennsylvania by the United States Commissioner, (Pennsylvania being without Commissioners.) They were taken charge of by James Worrall, Esq., Ex-Commissioner of Fisheries of our State, and deposited in the Susquehanna, near Harrisburg. During last fall we received from the United States Commissioner 20 000 of the *Salmo Quinnat*, which were placed in different cold spring rivulets and creeks emptying into the Susquehanna. We are still to receive 5,000 more of those salmon from the General government. One hundred and fifty thousand (150,000) eggs of this variety of salmon were sent to our State hatching house, near Marietta, by the United States Commissioner, but owing to several warm days, to the heat of which they were exposed during their journey, they arrived in such an unfortunate condition that it was only possible to save and hatch from them one thousand fish. These fish have also been set at liberty in one of the tributaries of the Susquehanna.

We have every reason to believe in the success of the attempted introduction of the salmon into our streams, from the fact that the young fish deposited in them are thriving and growing lustily. If the waters are adapted to their growth and prosperity, affording an abundance of food for the sustenance of the fish while young, we can conceive of nothing to prevent the annual return of these fish, after their emigration to the sea, except a lack of proper grounds for spawning. These are to be found in all of our large rivers. The salmon do not return from the sea to seek food, but simply for the purpose of propagation. They are like the shad—feeding entirely during their winter sojourn in the ocean, and fasting during the entire time they remain in fresh water. It is true that the salmon are taken by fishermen with the artificial fly, (so occasionally are shad,) but there is not a single instance upon record of any food ever having been discovered in the stomachs of any salmon or shad which have been caught in fresh water streams, any distance from the tide; although they have been frequently dissected with great caution, and subjected to the most minute and careful examination by scientists of both this country and Europe. This being true, taken in connection with the well known fact that the salmon return with unerring instinct to the waters in which they were reared, and from which they journeyed to the sea, only being deterred by the existence of some element which is unsuited and baneful to either the salmon or their young, we have no reason to doubt that in a few years more the introduction of salmon into our waters will have become an accomplished fact.

There are several stages of the growth of the salmon which are recognized by distinctive names. Within a few months of their hatching they closely resemble young trout, having bright vermillion spots somewhat similar to the trout but much paler in color, and fewer in number, running in one or two straight lines down the centre of either side the body, terminating at the anal fin. They have also dark rays or transverse bars running from the back down either side, terminating at or a little below the lateral line of the body. They are easily distinguished from the young trout by the careful observer by these markings, and also by their scales, which are much more perceptible and much more easily detached than those of the trout. As they approach the time of migration to the ocean, which is variable, (a portion of the young fish visiting the sea at the age of fifteen months, the other portion at that of two years and three months,) the transverse bars and spots disappear, they assume a bright appearance, a part of the back, head and belly being covered with silvery scales. It is now called a "smolt." They remain in the ocean after their first visit until late in the following spring. Their growth during these few months spent in the sea is marvelous. Upon leaving fresh water they weigh about a quarter of a pound, and when they return they weigh from two to eight pounds. On their first return to fresh water from the sea, they are called "grilse." A "grilse" is readily distinguished from the mature salmon by its small short head, by its fins and back of the head not being so dark as, and the markings on the side being more numerous than those of the salmon. After its second journey to the sea it returns a mature salmon, sometimes weighing as much as fifty pounds. We are exceedingly desirous, in order to have as much light as possible upon the experiment of introducing salmon in our rivers, to have any of our citizens who should meet with any salmon in the "parr," "smolt" or "grilse" state, caught in any of our streams, send us a full description of the same, the place where caught—and if the fish should be found dead or accidentally killed in catching—the fish itself.

SALMON TROUT.

As most of our large rivers abound with deep pools of still water, created by dams erected across their current, we resolved upon the introduction into these of some of the best varieties of salmon trout. We accordingly purchased of Seth Green, Esq., the Superintendent of the Hatching House of the State of New York, one hundred thousand of the eggs of the salmon trout. These eggs were conveyed, with little or no loss, from near Rochester to our State Hatching House near Marietta, by John P. Creveling, the Superintendent, where they are now in the boxes being hatched. These fish will be ready for transportation in February and March, at which time we propose depositing them in the different waters of the State, which we deem best adapted for their reception. As they are prolific breeders, of large growth, sometimes attaining the weight of thirty pounds, and exceedingly palatable as an article of food, being inferior in the latter respect only to the salmon, shad and trout, they will be a valuable addition to our food fishes. The fish from which these eggs were taken, were caught in

Lake Ontario, where they are so numerous as to afford a source of livelihood to large numbers of fishermen whose sole occupation consists in their capture and sale. We propose introducing as many of them as possible in the waters of the western part of our State.

PIKE PERCH.—(*Lucioperca Americana.*)

It is remarkable that this fish should, of all our waters, be found only in the Susquehanna and Juniata, where it is known by the extremely inappropriate name of "salmon." We have no doubt the misnomer of "salmon" was given to it on account of the peculiar color and flakiness of its meat. But it bears as little resemblance in all its habits, characteristics and markings to the true "salmon" as the black bass, (*Grystes Salmoides*,) which in the south is called trout, does to the true brook trout. The scientific name of *Lucioperca* adopted by Cuvier, indicates its affinity to both the pike and the perch. Mr. Theodore Gill places it in a sub-family "*Percidæ.*" This fish is identical with the glass-eyed or wall-eyed pike of our northern lakes, We do not believe it to be indigenous to these rivers, but that at some time it was transplanted from the lakes of New York, or the Ohio river, but we have no information when or by whom. The time for the spawning of these fish is in the spring. While fishing at the fisheries for shad, during their spawning season, they are frequently taken full of spawn. So little attention is paid by the fishermen to the advancement of their own interests, that these fish, although in such condition as to be about to yield a thousand fold, are rarely returned to the river, but are killed and kept by the fishermen. This reckless and indiscriminate taking of these fish has already made them exceedingly scarce in the Susquehanna, where forty years ago they were abundant, even as high up as within twenty miles of the headwaters of the Juniata. In the fall of the year they were at that time caught in such quantities by the people living along these waters that they were packed in barrels, salted, and in the spring carried to market and exchanged for goods and groceries. Experiments have been made in the artificial propagation of these fish which have yielded but few fish. It is the intention of your commissioners, however, to make further attempts at their artificial propagation, and if successful to stock our waters more generally with this variety of fish.

BROOK TROUT.

Owing to the fact that the trout is not a fruitiful fish, we have not deemed it politic to take any steps for the present towards hatching and disseminating them, but have determined to confine our labors to the protection, introduction and increase of more fertile varieties. We believe and hope that in a few years it will be practicable to re-stock the streams of our State adapted to them with this fish. With this purpose in view, we have now in the State Hatching House,. twenty-five thousand trout spawn undergoing the process of hatching. We purpose confining these fish in a pond, feeding and caring for them, and making them the source of future supplies in re-stocking trout streams. Our meaning when we speak of the unfruitfulness of trout will be readily comprehended when we state that the highest authorities agree in the statement that a mature, full grown trout wlll yield but from one to two thousand spawn. These are deposited by the fish and then left unguarded to fall a prey to predatory fish, fowls and animals. When this is compared with the yield of the bass, (40,000,) who, beside rendering this yield, guard their eggs and their young, or the 80,000 yield of the shad, which must be guarded by the care of man to yield abundantly, the increased result from the same amount of labor is very much against the former. We do not argue against the cultivation and dissemination of trout, but simply that it is better to leave that for future labor, and confine ourselves for the present more immediately to the introduction and re-stocking of our streams with more prolific varieties of fish. We recognise the fact that it is eminently desirable to have our streams re-supplied with these fish, and for this purpose we are preparing for it as labor to be undertaken in the future.

FISH-WAYS.

By the act of Assembly which created the Board of Commissioners of Fisheries, we were required to erect, and funds were placed at our disposal for the construction of, four fish-ways. Owing to the experimental character of the construction we were called upon to make we did not deem it prudent or advisable to expend more of the appropriation than was necessary to construct one fish-way. This we placed in the dam at Columbia, opposite a point which we were led to believe, from the best information we could gather, was most frequently used by the runs of shad in their ascent of the river. Fish-ways for the conveyance of all kinds of fish, except shad, over dams are easily constructed; but there is not to-day in existence in the world a fish-way which is known to allow free transit over dams for shad. Consequently it was made one of our duties to attempt the construction of four fish-ways for an object which no one had yet succeeded with certainty in attaining. We consequently believed that we were acting wisely and prudently in disregarding the requirements of the law, and instead of constructing four fish-ways, all of which would be experimental, and by the failure of which a loss of the entire appropriation would be sustained by the State, to construct but one, and after subjecting that to thorough and satisfactory tests, if it proved successful then to proceed with the erection of the others. The test which we propose is in the spring, during the run of the shad, to stake for a few days and nights a gilling net in a semi-circle around the upper end of the fish-way, leaving a considerable body of water between the net and structure. Every fish that makes the ascent of the fish-way will be caught in the meshes of the seine. This will enable us in a few days to discover whether the fish-way is a success or failure. While the fish-way constructed at Columbia must be considered in the nature of an experiment, yet we have full faith in its ultimate success. The character of the structure is such that we cannct see how the shad can fail in its ascension. Salmon and all other fishes can certainly ascend it with ease. But the shad being an excessively timorous fish, being halted by fear by the shadow of a bridge, will fail to surmount that which will prove no obstacle to any other of the finny tribes.

Many plans were submitted to us for our consideration at the time we were discussing the kind of fish-way that we should erect, most of these were patented by their inventors. But after giving them full and careful consideration we concluded that in order that a fish-way might be successful as a means of transit for shad, it should conform as nearly as possible to the natural falls of those portions of the river which they were habitually ascending in their annual journeys up the stream. And that owing to the difficulty presented to the fish of finding the fish-way, if built extending out below the dam, that it ought to be cut in the dam and extend back in the pool above the dam. We were led to the latter conclusion by the knowledge of the fact that the shad when stopped by an obstruction like a dam run along the obstruction seeking for an opening *in the obstruction itself.* If this is not there, but one hundred feet below the dam, the probability is that it will be found by very few of the fish. We consequently decided upon the erection of a simple trough, one hundred and twenty feet long by sixty feet wide; to cut this trough into the dam, and run it back into the pool above the dam about a hundred and ten feet; to protect the sides of the fish-way with strong abutments built upon both sides, and to run the water into the fish-way by having the upper end of the fish-way sunk two feet below the crest of the dam. This will give us a flow of two feet of water through the fish-way when the pool above the dam is full, but there is no water flowing over the dam itself. The inclination of the fish-way is but three and a half feet in one hundred and twenty. So that shad in making the ascent will have to rise but one foot in thirty-five. We were at first apprehensive that the flow of the water through the fish-way would be with such increasing velocity, gathering force and speed the farther it descended that it would be difficult for the fish to gain access to the fish-way at the lower end. But after debating this matter we concluded that the inclination being so inconsiderable, that the increased velocity of the water would be slight, and, beside that, this rapidity of the current would be checked by the water below the dam, backing into the fish-way and thus retarding the current at the point the fish would start upon their journey upon and through the fish-way.

Having arrived at these conclusions, we, in accordance with the requrements of the act of Assembly, approved April 28, 1873, advertised for sealed proposals for the construction of a fish-way in the dam of Columbia. These advertisements were inserted in the *Evening Telegraph*, *Evening Mercury*, *State Journal* and the *Patriot*, at Harrisburg, the *Columbia Spy*, *Columbia Herald*, *Marietta Register* and *Lancaster Intelligencer*. The proposals were invited for the construction of a fish-way to be erected in conformity with certain specifications, copies of which are attached as an appendix to this report. Upon the day fixed for that purpose, the sealed proposals were opened by one of the commissioners, at the time and place mentioned in the advertisement. There was but one bid. This we subsequently accepted, and entered into a contract with the bidders, Messrs. Sales & Brother, a copy of which is on file in the Auditor General's office; the specifications being herewith submitted. We decided upon the construction of the largest fish-way bid for, as there was a greater probability of success with a larger than a smaller structure. This fish-way was completed this winter, and was accepted by us on the ninth day of December, at which time we visited Columbia for the purpose of examining it. The cost of this fish-way was $11,053. This amount is made up as follows: Contract, $9,500; engineering, $750; extra work outside of contract, not over $400; advertising for proposals, $403.

All the dams upon the Susquehanna are already provided with a way for the ascent of fish, which, by an appropriation for the purpose, could certainly be made effective for the passage of shad. We refer to the existing navigation or rafting schutes. The reason that these schutes or sluices do not convey at the present time more shad from the lower to the higher reaches of the river, is principally owing to the fact that they are built extending from one to two hundred feet below the dam, and are not found by the shad which are seeking for an opening along the dam itself, to admit of their ascent. Although there is no doubt that the fishing in the immediate vicinity of the sluices frighten and turn from them some shad that otherwise would ascend. Some few shad do find their way annually through these schutes. We submit for your consideration the suggestion that it might be advisable to authorize by legislation, the erection of a cribbing extending from the one side of the schute to some distance in the river, running obliquely across and down the river, like a wing of a fish-basket inverted. This would stop and conduct into the sluice or schute a large number of shad, which, once there, would, without doubt, push forward beyond the dam. A device of this character, in connection with the successful operation of our fish-way at Columbia, we believe would make shad as abundant above the Columbia dam as they are now below it. This erection would be attended with an expenditure of from eight to ten thousand dollars. But it would certainly furnish the people for fifty miles above the Columbia dam with an abundance of shad. Whether the object to be attained would justify this additional expenditure, we leave to the consideration of those who have the final disposition of it.

THE STATE HATCHING HOUSE.

In the selection of a site upon which to erect our State Hatching House, we were governed by two considerations—that of an abundance of suitable water, and that of accessibility to railroads connecting the different sections of our State. After visiting and making inquiries in regard to the different springs in various parts of our State, we decided to locate our hatching house about two miles from Marietta, in Lancaster county, on Hoover's spring, one of the group of the famous Donegal springs. The water in this spring is exceedingly well adapted to the purpose, rarely varying more than two degrees in temperature throughout the entire year. We purchased of Mr. Hoover one acre of ground, and the right to use from the spring so much water as we shall desire for the use of the hatching house. The spring has an enormous capacity, yielding a flow of water equal to 3,000,000 gallons a day. We paid for the ground and the perpetual right to use the water, $2,000. It was necessary, in order to secure an additional fall, to increase the height of the water in the fountain of the spring; this we did by enclosing the fountain with a tight, compact wall. We had the house built by contract, advertising for proposals, and awarding the contract to B. F. Hiestand, the lowest bidder. The house was completed this fall. We believe that we have now the largest and best constructed fish hatching house in this country. The present hatching capacity of the house is nearly one million of eggs, which can be increased with no expense, if necessary, to three millions. The house is one hundred feet in length, by thirty-two feet in width. The water is conducted into the house through a six-inch iron pipe. After entering the house, it flows through a trough, running the entire length of the building, and is cleansed by a number of flannel screens, placed at intervals through the boxes. The hatching troughs are placed at right angles to the supply trough, from which they are fed by means of iron spigots an inch in diameter. There are seventeen of these hatching troughs, about 9 feet in length, and 30 inches in width. The troughs stand in pairs, so that the workmen can easily overlook them by passing on each side through a passage way left for that purpose. These troughs are raised about two feet from the ground, so that a person sitting upon a stool can readily examine the condition of the ova when they are hatching. The lower end of the troughs are an inch below that of the upper end. This gives a gentle current to the water which flows through them. For the present, the eggs are being hatched upon gravel. This plan we propose to discontinue during the coming season, and adopt instead the use of frames composed of glass rods, arranged parallel to each other, with interstices between the rods of about one-eighth of an inch, and held in their places by wire fastenings. This apparatus is an invention of Dr. J. H. Slack, one of the Fish Commissioners of New Jersey. We have employed to superintend the operation of hatching any ova which may be undertaken by the Commissioners, John P. Creveling, who has had several years' experience as a fish-culturist, and has been remarkably successful since he has been in our employ.

We respectfully suggest the appointment of a committee of the Legislature for the purpose of visiting and inspecting the fish-ways we have constructed at the Columbia dam, and the hatching house which has been built at the Donegal Springs near Marietta.

Owing to the unexpected expense which we were obliged to incur in the hatching of shad, by reason of our being obliged to pay Mr. Seth Green $2,000 for the right to use his shad-hatching boxes, and the cost of the hatching house having exceeded our expectations, the appropriation of $10,000 made by the Legislature in the act of 1873 was expended early in the winter. It thus became necessary to suspend operations or to take the responsibility of over-running the appropriation. If we had suspended our operations, the ova which we already had on hand would have been lost, and we would have been retarded in our efforts to stock our waters with salmon and salmon trout another year. Under these circumstances we deemed it prudent and politic, and believed that our citizens and Legislature would so regard the act, to take the responsibility of exceeding the appropriation. We have expended, during the present year, separate and apart from the money expended for the construction of the fish-way, about $12,000. This makes the expenditure over and above the appropriation about $2,000. The purpose for which this was expended can be seen by reference to our financial account, which is annexed to this report. We sincerely hope that this may be regarded as an act of as much wisdom as we considered it at the time of making the disbursement.

We point with a feeling of considerable pride to our labors since our appointment, eight months ago, believing as we do, that during that time we have made considerable progress in the work of restoring the fisheries of our inland streams. With the same manifestation of interest in this work by the present Legislature as was displayed by the last, and by placing at our disposal the same means of forwarding this material interest, we rely with great confidence upon a still greater measure of success in the future.

We are, very respectfully,

Your obedient servants,

H. J. REEDER,
BEN. L. HEWIT,
JAMES DUFFY.

APPENDIX.

SPECIFICATION

Of the manner of building a fish-way at the Columbia dam, as proposed by the State Fishery Commissioners, July, 1873.

A point about 60 feet east of the breach, in the dam which was made just west of Read's fishery, in the spring of this year, 1873, will indicate the western boundary of the fish-way. From this point a coffer-dam is to start, which will enclose the fish-way while under construction.

The fish-way will consist of two cribs, 120 feet long each, to be hereafter determined by the Commissioners, and 60 feet apart. These cribs will be made of pine or hemlock timber, counterhewed and laid close together, of the size of at least 8 by 10 inches; they will be 9 feet wide, exclusive of the sheet piling on the outside, and will be thoroughly tied inside in panels, of at most 8 feet apart, regular or breaking joints, by ties flatted, half dove-tailed and half-halved to the other timbers; and these last half spiked to the longitudinal timbers by spikes, as directed by the Commissioners, and half trenailed to the same with locust trenails of such size as may be directed by said Commissioners. They will be carefully filled with loose stone hand packed—no stone of which shall be so large as can not be passed through a 12 inch ring, nor so small as can not be passed through a 6 inch ring. On the outside they shall be sheet-piled with hemlock sheet-piling, 4 inches thick, scored to the bottom, if it be rock, or mauled down into the earth with heavy mauls, if it be composed of earth. The faces of the cribs shall be planked with three 3 inch hemlock plank, jointed and carefully spiked to the timbers. Where these cribs are joined to the body of the dam, they shall be carefully bound to the same in a strong and workmanlike manner so that there shall be no weak point that can be avoided. The tops of these cribs, which shall be level with the top of the dam, shall be floored or covered with 3 inch hemlock plank, carefully jointed, and spiked effectually to the top timbers and ties of the crib. The upper ends of these cribs shall be sloped at an engle of 45° to the current, and the slope mitred—the angle of the mitre to be covered with a strip of three-eighth inch iron, 6 inches wide, to protect them from the ice, or such other ironing, not more costly, as may be directed. The mitre and slope shall be planked with 3 inch hemlock plank, so as to be water-tight.

At the upper end of these cribs and below the mitres, a tie crib shall be built, binding the two together, which shall be 12 feet wide, and like the other cribs filled with stone, and similarly protected and strengthened by spiked and dove-tailed ties, &c. The upper 3 feet of this cross crib or dam shall be level at top, and be composed of 3 timbers 1 foot square, carefully counterhewed and leveled, the timbers to be laid close together. The top of the cross dam shall be 2 feet below the main dam; the remainder of the crib of this cross dam shall be sloped in the slope of the fish-way, which shall incline from the level of the three top timbers at the cross dam, to meet a cross timber at the toe of the main dam, 1 foot thick, and either thoroughly bound in with the cribs or fox-bolted to the rock, if rock is to be found at the toe of the dam.

From this lower cross timber until the line of slope reaches 2 feet above the bottom of the dam the space is to be filled with concrete composed of stone that will pass through a three inch ring, and a grout consisting of ½ first rate water cement, and ½ sand carefully poured into the space with buckets so as to be water tight, unless stone filling shall be substituted. After the depth of two feet is reached it will be optional with the Commissioners to adopt either cribbing, or hand packing with loose stone to within 1 foot of the sloped surface. This loose stone to receive a paving of stones of a foot in thickness, and no less than 1 foot in any other direction, and laid in full beds of cement mortar. But if cribbing be adopted, it shall be pannelled either regularly or irregularly with 7 inch flatted ties well spiked and fastened to timbers 8 by 10 laid up and down stream. The surface to be covered with 6 inch plank spiked or trenailed as directed, so as to make joints as tight as practicable. The work is to be carefully and thoroughly done in the manner used in building the soundest and best dam and crib work on the rivers of Pennsylvania. It must not be slighted in any repsect, and careless work will not be accepted.

The old fish-way now in the dam exhibits the kind of work that will be here expected—work that will not go away at the first freshet that occurs, but that will stand for years against all the forces to be brought to bear against it. The out side of the cribs and the cross crib will be thoroughly gravelled with clean, sound gravel, which will not wash.

Three ice guards may be placed above the fish-way, the upper ends of which shall be sloped, mitred and ironed, like the upper ends of the cribs; the tops of these will be at or above the level of the dam, at the option of the Commissioners, and they will be built strong and bound heavily with iron.

Upon the level top of the cross dam arrangements must be made, probably by sockets of cast iron, for studs, against which stop plank can be laid in dry times and to save water when the fish-way, not being in use, shall be of service to the dam. These will be about fifteen feet apart and well fastened to the timbers, having no unnecessary projection likely to impede the floating of bodies through the fish-way, thereby stopping it up or causing shocks to take place.

FINANCIAL STATEMENT OF THE COMMISSIONERS OF FISHERIES FOR THE YEAR 1873.

The State of Pennsylvania,

DR.	
To amount of appropriation	$10,000 00
CR.	
By amount paid Seth Green, royalty for hatching boxes	2,000 00
Do expenses hatching shad	728 25
Do for catching bass	777 00
Do for transportation of bass	441 70
Do Michael Hoover, for spring and grounds for hatching house	2,000 00
Do E. D. Roath, conveyancing	13 00
Do for cans for transporting fish	14 15
Do for erecting hatching house, plumbing and fixtures complete	3,690 89
Do John Krider, for nets, &c	67 00
Do for telegraphing	23 10
Do Columbia Spy for advertising	6 00
Do Columbia Herald do	3 00
Do Marietta Register do	5 00
Do O. A Waugh and D. Over do	8 00
Do John Hartzel, costs on legal proceedings	16 32
Do James Worrall, engineering, &c	400 00
Do for expenses in transporting California salmon,	345 62
Do for salmon trout spawn	174 00
Do for transporting salmon trout spawn	76 00
Do John Creveling, superintendent of State hatching house	401 00
Do James Duffy, personal expenses	112 00
Do B. L. Hewit do	165 48
Do H. J. Reeder do	220 71
Do for miscellaneous expenses at hatching house,	50 00
Do amount paid Adams' Express Company for transporting spawn	93 10
Total	11,831 32
Appropriation	10,000 00
Amount expended beyond specific appropriation	1,831 32

COMMISSIONERS OF FISHERIES THUS FAR APPOINTED.

UNITED STATES.

S. F. Baird, 918 New York Avenue, Washington, D. C.
(*Commissioner General.*)

MAINE.

Charles G. Atkins, Bucksport.

NEW HAMPSHIRE.

Thomas E. Hatch, Keene.
W. W. Fletcher, Concord.
W. A. Sanborn, Weirs.

VERMONT.

M. C. Edmonds, Weston.
M. Goldsmith, M. D., Rutland.

MASSACHUSETTS.

T. Lyman, Brookline.
E. A. Brackett, Winchester.
Thomas Talbot, North Billerica.

CONNECTICUT.

W. M. Hudson, M. D., Hartford.
R. G. Pike, Middletown.
J. A. Bill, Lyme.

RHODE ISLAND.

Newton Dexter, Providence.
A. A. Reid, Jr., Providence.
I. H. Barden, Scituate.

NEW YORK.

H. Seymour, Utica.
R. B. Roosevelt, New York city.
E. M. Smith, Rochester.

NEW JERSEY.

B. P. Howell, M. D., Woodbury.
J. H. Slack, M. D., Bloomsbury.
J. R. Shotwell, Rahway.

PENNSYLVANIA.

J. Duffy, Marietta.
H. J. Reeder, Easton.
B. L. Hewit, Hollidaysburg.

VIRGINIA.

Asa Wall, Winchester.

ALABAMA.

C. S. G. Doster, Prattville.
D. R. Handley, Mountain Home.
Robert Tyler, Montgomery.

MICHIGAN.

Gov. J. J. Bagley, Detroit.
G. H. Jerome, Niles.
G. Clark, Ecorse.

CALIFORNIA.

B. B. Redding, San Francisco.
S. R. Throgmorton, Sacramento.
J. D. Farnell, Sacramento.

CANADA.

P. Mitchell, Minister of Marine and Fisheries, Ottawa.